Liquid Crystals for Photonics

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Abstract—A brief editorial overview of liquid crystals for photonics is presented in view of the recent scientific event held in Hong Kong in December 2010.

The purpose of the Workshop Liquid Crystals for Photonics 2010 (http://lcp2010.ust.hk/index.html) held at the Hong Kong University of Science and Technology from 8th to 10th December 2010 was to provide an Asian forum for liquid crystal (LC) scientists, researchers, and engineers from all over the world to present their pioneering work on recent progress in LC research for photonics and displays and to exchange their ideas. The discussions provided a state-of-the-art overview of the area, highlighting the latest advances and possible future directions.

The Workshop had a large number of plenary (5) and invited (26) speakers from the USA, Canada, Europe, Japan, Taiwan, Hong Kong, Singapore, Russia, China (15 countries in total), to enable cross-fertilization among researchers working in LC materials and devices.

The Workshop had papers on interesting and novel applications such as fiber sensors (Prof. Shum, Singapore) and Prof. Lu (China), optical wavefront control devices (Prof. Bos, USA), LC optical waveguides (Prof. d' Alessandro, Italy and Prof. Neyts, Belgium), THz LC devices (Prof. Parka, Poland and Prof. MacPherson, Hong Kong), beam steering elements (Prof. Valyukh, Sweden), silicon microdisplays (Prof. Underwood, UK), 3D devices (Dr. Surman, UK), solid state lighting (Dr. Huang, Hong Kong). Certain presentations were devoted to enhancing LC material properties for photonic and display applications, such as blue phases (Prof. Wu, USA), azo-dye doped LC (Prof. Fuh, Taiwan), photoresponsive LC (Prof. Tabiryan, USA), polymer-dispersed LC (Prof. Sun, Singapore), metamaterials (Prof. Khoo, USA), smectic nano-structures (Prof. Pozhidaev, Russia), fast switching LC (Prof. Komitov, Sweden), colloidal particles (Prof. Zumer, Slovenia), photocontrollable liquid crystalline polymers (Prof. Shibaev, Russia), new active matrix LCD materials (Dr. Takatsu, Japan), novel optical geometries for viscous-elastic measurements and LC fiber optics applications (Prof. Pasechnik, Russia).

An excellent presentation on arbitrary spatially varying pretilt angles was made by Prof. Kwok (Hong Kong), who also made a review of recent applications of this technique in tunable LC lenses, beam steering and diffraction LC devices.

Prof. Chigrinov (Hong Kong) outlined in his presentation the HKUST photoaligning materials based on azo-dye photosensitive layers for various applications in LC photonic devices.

Prof. Wolinski (Poland) and Prof. Tabiryan (USA) mentioned a variety of tunable LC photonic elements that used photoalignment technology, such as LC-filled photonic crystal fibers, switchable q-plates and photo-tunable band gap LC materials.

Prof. O' Neill (UK) also discussed photoalignment technology to orient light emissive semiconductor materials to enable a polarized source of emitting light.

An interesting presentation of new LC applications for polymer planar lightwave circuit devices was made by Prof. Chan from City University in Hong Kong. He considered LC as an excellent new material for tunable LC photonic devices based on polymer fibers.

Prof. Aaron Ho outlined in his presentation the application of optical retardation modulation in phase sensitive surface plasmon resonance biosensing. He considered LC as a new material, which can make plasmon sensors properly tunable in a wide range of light incident angles.

Several researchers provided theoretical investigation of new LC modes suitable for photonic applications, such as localized optical modes for efficient lasing in chiral LC (Prof. Belyakov, Russia), computational generation of optical signals and textures developed in LC systems (Prof. Hwang, Canada), polarization gratings and electro-optics of deformed helix ferroelectric liquid crystals (Prof. Kiselev, Ukraine), blue phases textures (Prof. Wu, USA and Prof. Zumer, Slovenia), ordering and alignment in LC-metamaterial composites on macroscopic and molecular scales (Dr. Gorkunov, Russia).

The sponsors of the event were Croucher Fondation, School of Engineering and Department of Electronic and Computer Engineering of the Hong Kong University of Science and Technology (HKUST).

